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AMENDMENTS TO SPECIFICATION

The specification is amended as follows:

[0009] Optical system 20 also utilizes a flexible first quarter wave retarder 44 directly adjacent to DBEF 40, which itself is flexible. Since DBEF 40 is used in reflection along the desired light path, it must necessarily be flat to provide a distortion-free reflected image. However, laminating flexible DBEF 40 directly to flexible first quarter wave retarder ~~56~~ 44 results in an undulating DBEF surface and, hence, a distorted reflection. The manufacturing complexity of maintaining flatness in flexible DBEF 40 while laminated (or optically coupled) to flexible first quarter wave retarder 44 on one side and first linear polarizer 32 on the other is apparent. Thus, DBEF 40 must be laminated to its own flat glass substrate (not shown) prior to lamination to first quarter wave retarder 44 and additional polarizing and anti-reflective glass elements. This additional step results in optical system 20 including a subassembly having three rigid substrates, including two anti-reflective glass components, along with three sheet-type polarizing elements, resulting in a substantial manufacturing complexity. Regarding DBEF 40 itself, the stand-alone contribution of this element to the overall throughput of the entire system is about 49%, i.e., about 70% reflection and about 70% transmission.

[0011] Accordingly, it is desired to obtain a compact meniscus-type real image projector having higher brightness and contrast and better manufacturability than optical system 20, while retaining or improving the superior system size and field of view characteristics of that system. Several improvements for enhancing the image characteristics of optical ~~system of~~systems are disclosed herein.

[0029] An additional area of improvement over the current generation of DBEF-based real image display optical systems is the incorporation of "matched" first and second quarter wave retarders 120, 132 that cooperate more advantageously with the bandwidth response of the other polarizing elements (specifically, either the broadband reflector-polarizer of the present invention or the DBEF of a conventional DBEF-based optical ~~systems~~system). Inefficiencies that lead to a dimmer image and greater bleed-through or contrast degradation result when the

different polarizing elements respond to different wavelengths with different efficiencies. Obvious sources for this type of error are the quarter wave retarders, e.g., first and second quarter wave retarders 44, 56 of optical system 20 of FIG. 1, the design wavelength of which is simply centered in the visible spectrum, i.e., at 560 nm. Thus, such quarter wave retarders have decreasing efficiency at wavelengths higher and lower than 560 nm. These inefficiencies manifest themselves primarily as increased bleed-through (or decreased contrast) in the final image, especially at oblique viewing angles.

In the abstract:

An optical system (100, 200, 400, 500) that projects a real image (140, 412, 504) into space and includes one or more features located along the optical path that enhance the viewability of the real image. The optical system includes a converging element (128, 208, 416, 528) for converging a portion of source light (104, 516) so as to form the real image. One viewability-enhancing ~~features~~ feature is the use of a broadband reflector-polarizer (124, 208, 408, 532) having high transmitting and reflecting efficiencies. Another viewability-enhancing ~~features~~ feature is the use of polarizing elements (116, 124, 136, 408, 420, 424) having substantially matched bandwidth responses and/or comprising an achromatic design. An additional viewability-enhancing feature is the use of a wide-view film (144) to increase the viewing angle of the image.